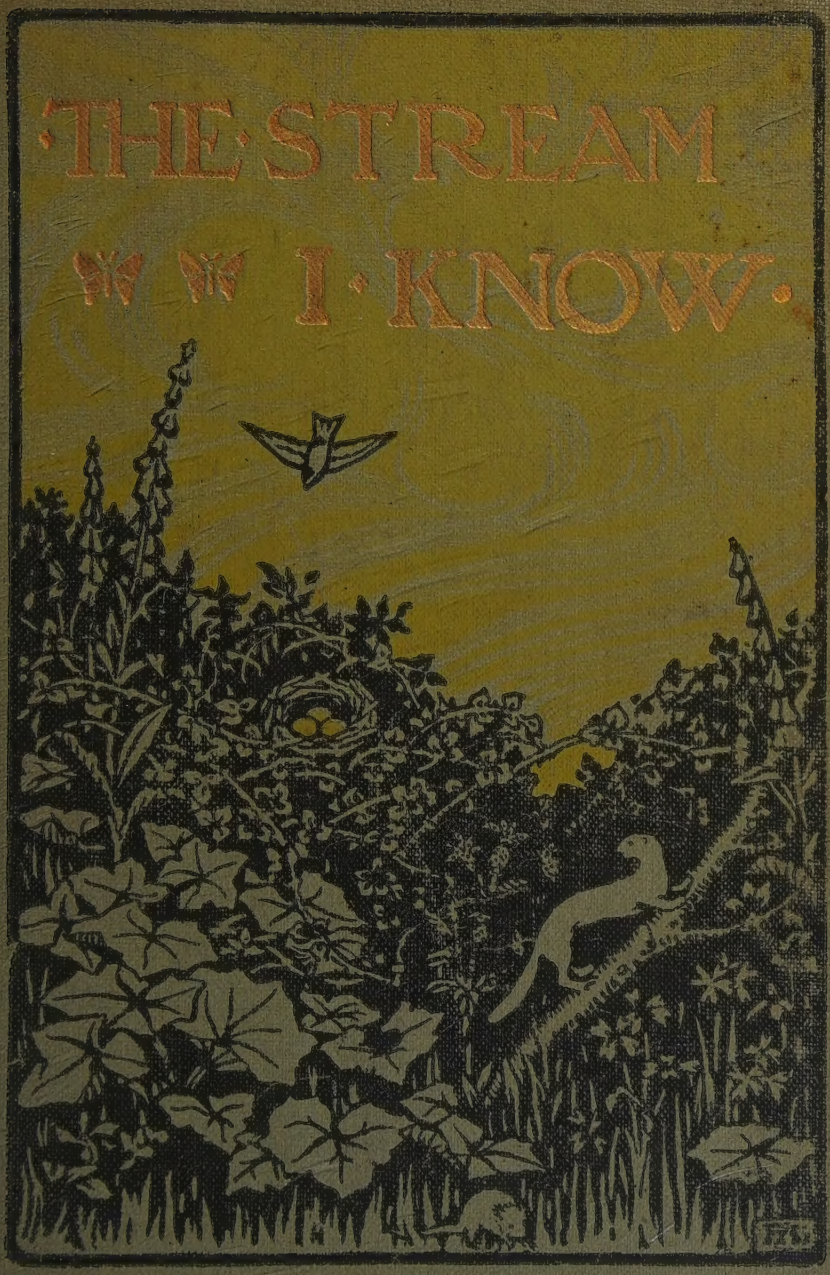
THE STREAM I KNOW



E. A. Parkes
from D.C.S.
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THE STREAM I KNOW

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THE STREAM I KNOW

EDITED BY
W. PERCIVAL WESTELL, F.L.S.
& HENRY E. TURNER
General Secretary of the School Nature Study Union

WITH
13 COLOURED
& MANY BLACK AND WHITE ILLUSTRATIONS

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" Nature study is a means of obtaining knowledge which may rightly influence the conduct of the individual. Knowledge is still the object, but it is not the knowledge that lies, like the miser's hoard, unproductive while other heaps are accumulating; it is rather like the wealth which is continually current, and is ever ministering to the necessities and comforts of mankind."

JOHN RUSKIN.

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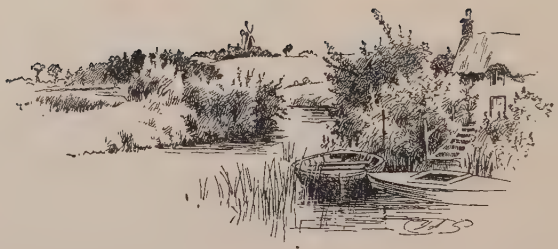

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THE STREAM I KNOW

I.—INTRODUCTION

THE BABY BROOK—A SURFACE SPRING—WATER ACTION—THE SPEED OF A STREAM—ITS CURVES—AND USES

When we write the history of a famous man, is it not our usual custom to comment upon the days of his childhood and youth? Do we not love to discuss the character that he then displayed, and to describe the scenes amidst which he dwelt?

And those whom we call our friends—even though they be far removed from the ranks of the famous—what of them? Are they not at all times and under all conditions most interesting to us? Their habits, their sayings, their home, surely these form part of our most cherished recollections?

So let us deal fairly with the stream, for with the famous things of the earth it most certainly ought to rank, and among our friends it most certainly should be.

Come, then, and climb up yonder hill, for there must we seek the cradle of our stream! The baby brook is at first so frail, so feeble, that one can scarcely believe that one is witnessing the early struggles of a future warrior.

Perhaps you consider the word "warrior" a term scarcely suitable to be applied to a river; but withhold your decision until you have heard of its brave struggles against unfavourable conditions, of difficulties faced and overcome, of battles fought and victories won, all by the untiring patience

and persistent plodding of its slow-moving waters. At last, having done its duty, the majestic river—for such it will become—enters, and is lost in, the great sea beyond.

Have you found the cradle of which we have just spoken? Yes, there it is, that small hollow in yonder rock! Out from this issues a tiny streamlet fed by a bubbling spring. Some of you may wonder how the spring came there, for although we can only see it as it bubbles from the ground, yet we are quite sure that bare rock cannot produce water from nothing; therefore let us trace the matter back a step further.

"When the rain-water falls upon a porous rock like Sandstone, or one like Limestone penetrated by joints or fissures, it continues to travel downward till stopped by some impervious and unfissured rock like Clay. It is then compelled to travel along the junction plane of the two rocks, and if it comes to the surface again by travelling steadily down-hill, it issues as a *surface spring*."[1] Here, then, we have the true origin of our stream, which is in very truth the child of the clouds.

Down the steep hill-side it scampers, singing on its way, jumping from ledge to ledge, and carving out a path where perhaps none existed before. Here and there it joins forces with other happy streamlets, all as eager and agile as itself; together they make their way ever downwards, until the hill-side merges into the plain beneath.

But in this hasty flight what a havoc is made among the surrounding hills! Gradually the would-be rivers deepen their channel, and sweep before them fragments of rock, which the rain and frost have split from off the neighbouring crags. What is the result of all this apparent waste?

"Suppose, for the sake of distinctness, that one special

[1] *Geology for Beginners*, by W. W. Watts.

crag could be singled out, the rock of which, from its colour or composition, might be distinguished, even in small fragments, from those of the crags round about it. Rising boldly from a steep hill-side, it looks perhaps down a long slope to the little stream, which in the distance seems a thread of silver winding through the green meadows far below. In the long course of time, rain and frost have carved the front of this crag into deep clefts and gullies, which, when wet weather sets in, become each the channel of a torrent, that pours down the slope and sweeps away every loose bit of stone or earth within its reach.

"The stones first fall or are swept from a hill-side into a brook as mere angular chips. But by the time they have travelled down the brook a little way, and have suffered from the grinding of a few floods, they lose their sharpness and become more or less rounded, until at last, after some miles of transport, continued, perhaps, during several years, they appear as well-worn Gravel. A rounded stone will travel farther and faster than an angular one, but may in the end be worn done into mere Sand.

"As the stones grow rounder, they necessarily at the same time become smaller. And as they not only wear away each other, but also grind out the sides and bottom of the channel of the brook, a good deal of stone must be consequently rubbed down into Sand and Mud.

"The finer particles, being more easily moved, travel farther than the coarser fragments. Hence, while Gravel and coarse Sand are pushed along the bottom, fine Sand and Mud are carried along, suspended in the moving water, which may transport them many miles before they can slowly sink to the bottom, there to form a deposit of Silt or Clay." [1]

[1] *Geology*, by Sir A. Geikie.

Would you like to discover the speed of our stream? Well, then, spread yourselves out along its banks so that between each of you there is a distance of ten yards. The boy farthest up the stream must now launch a tiny boat—a small piece of cork or even cardboard will serve the purpose. As soon as the frail messenger is on the move, be careful to note the exact time; a similar record must be taken at the very second the boat reaches the spot opposite each boy, who should shout out loudly enough to warn the time-keeper of its approach. Thus we obtain a series of results, a series showing the various times taken by the boat to travel ten yards. An average rate can then be obtained, when a simple proportion sum is all that is necessary to discover the speed of the water per hour.

All regardless of watches and such like, our stream glides calmly on, winding first one way and then the other; here it bends to the left, and there to the right, seeking those places where the slope—so slight at times as to be almost imperceptible—helps it on towards its final goal.

Even in these bends there is something of interest. Look at them closely! Can you see any difference between the opposite banks? Does not the *outer* or *concave* curve of the river, where the speed of the water is greater, wash a steeper bank than the *inner* or *convex?* Why should this be so?

The answer is partly suggested in the question, for the bank which overlooks the swifter current is the more likely one to be robbed of its soil.

One bank is being washed away, and is more or less steep; the other is being built up, and is consequently inclined to slope gently. This "laying waste" and "reclaiming" are, of course, much more apparent in large

rivers, but the result is the same in both cases—the course of the river is shifted.

But we must not forget that a river is something more than a thing of beauty, for its uses are great and manifold. Not only is it the chief source of our water supply, but it irrigates our fields and makes fertile the soil. Are not our boats borne upon its placid bosom, and do not its waters abound in fish? In our work and in our play it is our constant friend and helper, asking nothing for its services and claiming no reward.

Truly it is not a matter for wonder that, among the idolatrous nations, there be those who worship their river, regarding it as the gift of heaven, a special favour granted to mankind. The holy Ganges and the sacred Nile have brought blessings untold to countless human beings, who, in return, regard the river with reverence and awe, and in gratitude enshrine it among their gods.

II.—WATER-LOVING PLANTS

GREATER WILLOW HERB—HEMP AGRIMONY—COMFREY

If you had to spend all your life in a pond or in a stream, would you not take steps to ensure that you were prepared for your watery surroundings? Your first care, no doubt, would be to protect yourself in such a way that the stagnant pool or rippling brook should do you no harm; indeed, you would endeavour to derive the greatest possible benefit from their presence.

Thus it is with the water-loving plants; in the course of years, Nature has gradually adapted them to their environ-

ment. Usually we find that their stems are slender, since the buoyancy of the water affords them nearly all the support they need. When the stems are of a sturdier growth, we frequently find they are sword-shaped, and thus do not impede the flowing water to any appreciable extent.

Their submerged leaves are very often much divided, and do not possess stomata, those tiny mouths by means of which they breathe; the leaves which float *on* the water, however, have these stomata on the *upper* or exposed surface, so that they may come into contact with the air.

"Stomata" is the plural of "stoma," a term derived from a Greek word meaning a mouth. These stomata are special openings, microscopic in size, through the outer skin of the leaf or young stem, and are for the breathing and feeding of the plant; by their means, also, the aqueous vapour escapes in the process known as Transpiration.[1]

They are nearly always found on the *under* side of the leaf, away from the glare of the sun. But this rule, as has already been shown, varies in exceptional plants; thus the Iris has them on *both* sides, whilst the Water Lily has them on the *upper* surface. Usually the stomata are closed at night.

Now that we know the type of flower we are likely to meet with in our stream, had we not better walk along the bank and gather a few specimens? It is true that we shall find many plants that we have previously seen in, and gathered from, the pond, but these we can ignore for the present, and confine our attention to the things that are new.

Look at yonder tall plant, for instance! What do its long narrow leaves with their sharply-toothed edges remind you of? "Those of the Willow," did you say?

[1] See *The Wood I Know*, p. 13.

Greater Willow Herb.

Brooklime.

Yes, that is true, and it is for this reason the plant is called the Willow Herb.

We have many species of Willow Herb in all parts of Great Britain, but the one which graces the edges of our stream is tall and very hairy; indeed, the whole plant is of a woolly nature, and is therefore spoken of as the Great Hairy Willow Herb.

July and August are the months in which we see it at its best, for then the large rosy-purple blossoms, each with its four notched petals, are greatly in evidence.

Fig. 1. Seeds and Seed-vessels of Greater Willow Herb.

The sturdy stem, which branches in all directions, often reaches to man's height, and is clasped by the stalkless leaves. Should you try to pull it up by its roots, you will not have a very easy task, for these creep hither and thither, sending up shoots at frequent intervals.

Perhaps the most interesting stage of the Willow Herb is the time when it casts its seeds. What was apparently the long stalk of the flower turns out to be the ovary or seed case; this splits up into four long strips, which curl back and reveal the seeds, each with a tuft of silken hairs of great length. These delicate filaments are buoyed up by the passing breeze, and thus the seed gets borne away to fields and pastures new.

Another tall plant, whose roots love to penetrate widely and deeply into the soft rich mud, is the Hemp Agrimony. Its rounded red-tinted stem gives one the idea of strength and solidity, but in this case appearances are somewhat deceptive, for the central part is full of white pith.

The dull green leaves are arranged in pairs, and may almost be described as stalkless; each leaf is slightly downy

and is deeply cut into lance-shaped leaflets from three to five in number, all having serrated edges.

Towards the top of the stem are several branches, which are crowned by clusters of pale purple or lilac-coloured blossoms. The latter belong to the simplest of the composite group, each flower head having only five or six florets, the ray florets being entirely absent.

These blossoms, grouped together as they are in such large numbers, and containing as they do such plentiful supplies of honey, form the happy hunting-ground of many a Butterfly and Moth; indeed, at certain seasons of the year, the Red Admiral and the Peacock may be seen there in joyful swarms, and by their aid the fertilisation of the plant is brought about.

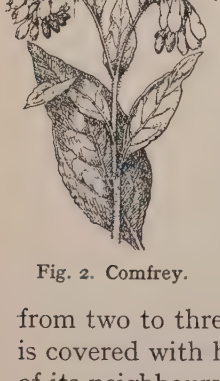


Fig. 2. Comfrey.

Tall flowers are the rule rather than the exception in moist places, and a further illustration of this is the Common Comfrey. This large and handsome plant has a stem from two to three feet in height, and angular in shape. It is covered with hard, rough hairs or bristles, and like many of its neighbours it is hollow.

Once the plant has established itself in the soil, it is a difficult matter to eradicate it, for the roots are extremely brittle, and the smallest portion will grow.

The coarse hairy leaves are narrow and pointed and " are all but stalkless, their bases running down the stem in such a manner as to give it a winged appearance; " those which spring direct from the root are broader and possess stalks.

Towards the end of April the blossoms begin to appear, and these may be seen until Autumn puts an end to their

beauty. They vary in colour from a pale yellow to a rich purple. The five petals form a bell, the edges of which are deeply toothed. These bells are arranged in drooping clusters, and are hung from a very short stalk.

III.—MORE WATER-LOVING PLANTS

PURPLE LOOSESTRIFE—GREAT YELLOW LOOSESTRIFE—BROOKLIME—WATER-CRESS

PERHAPS one of the chief characteristics of the tangled mass of vegetation adorning the banks of our stream and other moist places is the intense green of the leaves. It is true that this colour prevails in almost every plant community, and surely there must be some reason for this.

The green colour of plants is *never* the result of coloured sap, but is a special substance called Leaf Green. Those of you who love hard words, and wish to call things by their exact name, may like to know that the correct term for this is Chlorophyll. It can be extracted from the leaves by soaking them in methylated spirit.

The presence of light is necessary for the manufacture of this colouring matter; thus the whiteness of such well-known foods as Celery and the heart of a Cabbage is explained by the fact that these vegetables have been grown in the dark, the former underground and the latter under cover of the large outside leaves.

A certain amount of warmth is also requisite, and the yellow tinge, which we find in our Spring bulbs, is probably the result of cold impeding the complete formation of Leaf Green.

But when it *has* been formed, of what use is it? Experiments have proved beyond all doubt that it is only by the aid of this colouring matter that plants, *in the presence of light*, can form the starch [1] upon which they feed, and give off the oxygen which purifies the air. Hence it is no longer surprising that green should be everywhere in evidence, since upon its presence the very life of a plant depends.

It is time, however, that we continued our walk by the side of the stream, for much remains for us to see and examine ere yet our task be complete.

Look among yonder Sedges and Rushes! Do you see that tall handsome plant with its tapering spikes of purple flowers, which, from this distance, we might almost mistake for a Foxglove? It is the Purple Loosestrife, and grows in great abundance in watery places. Let us get nearer to the plant, for it is well worth our attention.

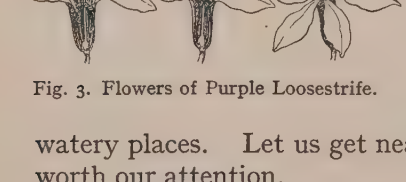


Fig. 3. Flowers of Purple Loosestrife.

This stem, as you can see, is square, but such is not always the rule, for you may often find a specimen with five or six sides. The lance-shaped leaves run in pairs, and, being stalkless, they clasp the stem.

The blossoms, often one inch in diameter, may be looked for from July to September; they are sometimes described as purple stars, for the six long and narrow petals radiate from the centre and stand out quite clearly from each other; these are supported in a tube-like calyx, the edges of which are cut into twelve teeth, six of them being large and six small.

Again, the blossoms are arranged in clusters around the

[1] See *The Hedge I Know*, p. 19.

stem, each cluster being separated from the one above and below by a pair of leaves.

Really the plant has no right to its name, for the true Loosestrife is yellow in colour, and belongs to quite a different family. "Both are equally common, both are found in the same localities, and both are called Loosestrife, and there the resemblance ends." Our forefathers made the blunder; they wrongly christened the plant, and the error has been allowed to remain.

Good luck seems to be with us, for there, sure enough, is the *true* species. Would you like to hear how it obtained its name?

Years ago it was commonly thought that the plant had the power of calming certain restive animals; for instance, when put beneath the yokes of the oxen at plough, it made them quiet. One does not require further information to understand how the name Loosestrife came into circulation. Although it is extremely interesting to trace back these matters to their beginnings, we are forced to admit that our ancestors were very rough and ready in their methods, and that their knowledge of Botany could scarcely be described as perfect.

However, let us leave the past and deal with the present! This Yellow Loosestrife, for instance, is cousin to Creeping Jenny, and also a distant connection of the Primrose. We met with another of its relatives when tramping through the wood, the Yellow Pimpernel to wit. Its size, and the brilliant yellow of its flowers, make it conspicuous even amongst its big neighbours.

Yellow Loosestrife is a perennial; therefore, as soon as it has taken up its residence in suitable quarters, it may be looked for year by year adorning the same spot.

The leaves taper to a point and grow in whorls clasping

the stem. This, perhaps, is a phrase you will not quite understand, until you have learnt that a whorl consists of three or more leaves—or at times blossoms—arranged in a circle around a stem.

From the axils of the upper leaves come the stalks which support the clusters of yellow blossoms; these are somewhat bell-shaped, dotted inside with orange. The calyx is deeply cut into five segments, each of which is daintily tipped with red.

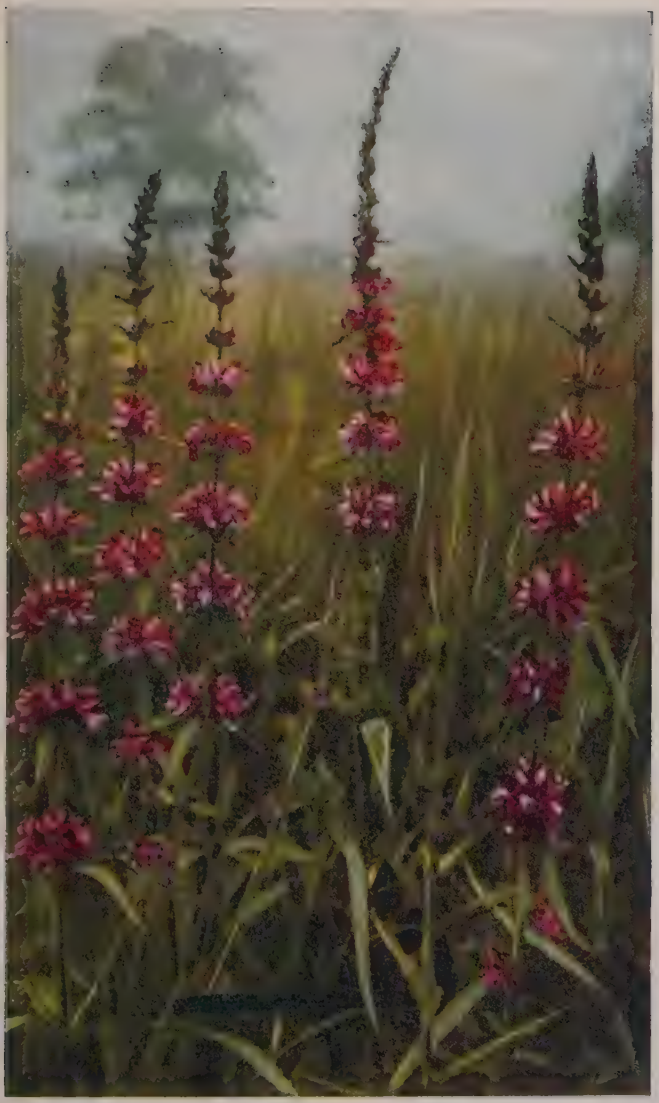
Fig. 4. Brooklime.

In the study of flowers, one of the most interesting points to notice is the manner in which two specimens of the *same* group will vary one from the other, according to their environment.

An excellent illustration of this may be found among the Speedwells. Those which grow in dry places have to be protected from certain creeping insects, and consequently are often covered with hairs, especially at the entrance to the tube down which search must be made for the honey. Again, their seeds are sometimes dispersed by means of tiny hooks on the calyx; the latter gets attached to the coat of some animal, and the contents are thus carried away from the spot where they first saw light.

The Brooklime, however—the Speedwell that frequents our ponds and streams—is smooth, doubtless because the water not only affords sufficient protection from the inroads of Ants and such like, but can act as an excellent carrier of seeds.

You will not be surprised to find that the stem is round, hollow, and juicy. This has a tendency to trail, throwing out bunches of rootlets from its lower portion, and at intervals sending up flowering stems. Each of these stands



Purple Loosestrife.

Water Cress.

erect in its muddy bed, and has its smooth glossy leaves arranged in pairs; the latter are oval in shape with edges best described as wavy.

Many people confuse the Speedwell with the Forget-me-not, and at first glance there is some excuse for this; notice, therefore, that whereas the latter has five petals all of equal size, the former has four, one of which is smaller than the rest.

Shall you be surprised if you are asked to hunt for Water-cress? Can you believe that it is indeed a plant having roots, stem, leaves, and blossoms like any other flower? Or have you bought it so often for "tea" that you have gradually grown to believe that it can only be found in a greengrocer's shop?

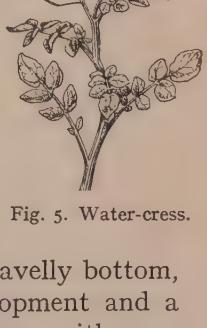


Fig. 5. Water-cress.

Should you have any doubts on this point, come along to a quiet backwater that we shall find about ten minutes' walk up stream. There you can see a bed of Water-cress in blossom—a veritable sheet of white.

"This plant grows most luxuriantly in clear and gently moving streams having a gravelly bottom, and the plants have then a far finer development and a richer flavour than those that have sprung up either on mud or in almost or quite stationary water."[1]

The roots of Water-cress are long and creeping, and possess numerous tufts of slender white fibres. The plant is easily removed, and if cast upon the stream will probably find a quiet shallow spot wherein it may again take root.

Come and gather one of the pure white blossoms. What does it put you in mind of? "The Wallflower," did you say? Yes, it belongs to this great family, as the cross-

[1] *Familiar Wild Flowers*, by F. E. Hulme.

wise arrangement of the four petals clearly indicates. Later on the long seed pod will appear, a further proof that the plant is akin to the Wallflower.

Many years ago Water-cress was introduced into New Zealand, where it has flourished to such an extent as to become a nuisance. The huge stems formed a network across rivers and other water-ways, putting a stop to navigation; the local authorities have had to spend hundreds of pounds per annum to keep down the growth.

IV.—WATER-SIDE COMPANIONS

RUSHES—SEDGES—MOSSES—LIVERWORTS

You must not imagine that every plant growing by the water-side is worthy of a place in a bouquet, for such is not the case. All are interesting, even though they can scarcely be described as beautiful. Some, alas! seem to have fallen on evil days, and although they exactly suit their damp and often dismal surroundings, yet, judged from a botanical point of view, they are very low down in the scale of plant life.

Among these we must place the Rushes, which "may best be described as degenerate Lilies—plants that have turned their backs on the insect friends that have induced so many of the family to become brilliant, gaily-coloured, and often sweet scented."

"They appear to have argued that expensive petals richly coloured, with their adjuncts sweet perfumes and sweet liqueurs, made too heavy a demand on their resources; they must retrench. They have retrenched to

such an extent that all-round degeneration has resulted—simple stems, leaves scarcely recognisable as such, and poor little brown or green flowers massed together and fertilised by the winds." [1]

Thus, in the course of ages, they seem to have resigned their right to a place in the richer soils, and have crowded together as a tribe of marsh or bog plants. Tufts of them may be seen dotted here and there in pasture lands, but then they are a sign of insufficient drainage.

Fig. 6.
Heath Rush.

Generally speaking, Rushes are perennials, with roots that creep and send up fresh plants. The stems are erect, usually unbranched, and filled with pith. The leaves are flat or cylindrical, but at times they are no more than a series of scales clasping the stem.

Nevertheless, they have proved of great use to man. With them he has repaired his chairs, woven his mats, and plaited his rope. Fresh Rushes, strewn over the floor, made an excellent substitute for the more modern carpet; indeed, a fresh supply in the castle hall was an ancient method of honouring a distinguished guest.

Gilbert White tells us how, by carefully dipping the Rushes in grease with a little wax added, the poor man might enjoy five and a half hours of light for a farthing. What economy is here, to be sure!

But even in the world of Nature they have their use, for just as Grasses will aid in reclaiming sandy wastes, so Rushes tend to " fix " the soil of many a marsh and bog.

Side by side with these you will find the Sedges—plants so often confused with Grasses. May we not as well learn

[1] *The Romance of Wild Flowers*, by Edward Step.

the differences between them at once? "The stem of a Sedge is always solid and generally triangular; that of a Grass is generally hollow, rounded, and never three-sided. The leaves of a Sedge are in three ranks; those of the Grass are alternate in two ranks. In both, the leaves embrace the stem with sheaths, but in Grasses the sheaths are nearly always split, while in Sedges they are not. Further, where the leaf-blade joins the sheath in Grasses, the inner side of the sheath is more or less prolonged into a sort of membranous edging known as the ligule, whereas a Sedge has no ligule."[1]

Figs. 7 and 8.
A. Greater Pond Sedge.
B. Rough Cock's-foot Grass.

A few Sedges grow in dry places, but the majority prefer moist soils; indeed, they form the sole vegetation of some swamps, which, in time, they have been known to convert into dry land.

Before we introduce ourselves to other of our water-side companions, let us make quite sure what parts we are to look for in the highest type of plant.

Firstly, there are the roots, which anchor the plant firmly in the soil, and absorb from the latter not only the moisture, but a weak mineral solution necessary for the feeding of the plant.

Then there are the leaves, the organs by means of which a plant breathes, absorbs carbon dioxide from the air, and manufactures starch. Remember, too, that the leaves are the "headquarters" for Transpiration.

[1] *Manual of British Grasses*, by W. J. Gordon.

We must not forget the vessels which carry the food to all parts of the plant, and which can be seen so clearly in the leaves.

Lastly, there are the decorative and reproductive parts, viz., the blossoms and the seed. These bring no nourishment to the plant they ornament, but, on the contrary, they depend upon the other parts for their sustenance, and are often a great tax on the resources of the plant.

Judged from this standpoint, the Fungi that we discovered in our meadow must be numbered among the lowly; the Mosses, however, which we shall find on the stones and banks of our rippling stream, are of higher rank, for some of them possess leaves, stems, and roots of a kind, although no true Moss can boast of vessels.

Beginners are inclined to regard Mosses as being all alike in appearance and habitat, but "the tops of walls, the banks of lanes, the shady woods, the mountain passes, each inhabited by different classes of Mosses, are as distinct in their vegetation as the Oak, or Elm, or Beech counties of England, or the Pine-clad slopes or the Birch groves of the Alps."

Unfortunately we have not the time just now to prove the full truth of these remarks, but keep your eyes open, and you will be surprised at the number of different kinds of Mosses you may gather, even in one day's walk by the side of a stream.

Shall we clamber over these rocks? Here, sure enough, are specimens galore. Be careful how you go, for the path is slippery, and sprained ankles are more quickly obtained than got rid of.

Here is some Moss that seems to be growing into the stone itself. Pull it away from its hard rocky bed, and examine the tiny and finely pointed roots, for it is by means

of these it can penetrate into, and find a footing upon, surfaces that other plants might despair of.

The leaves are usually of a clear green, shaded with golden brown or different tints of red and purple; they may be arranged spirally round a stem, but "they are never opposite, never whorled, never on leaf stalks, never truly veined, never compound, and never furnished with stomata.

"We must remember that the whole mode of life of a Moss Plant, especially as regards its water supply, is very different from that of higher plants. Many Mosses often grow in places such as the tops of walls, or in sandy soil, where they are liable to be completely dried up in hot weather. Yet they are none the worse, and revive as soon as rain comes again. This rapid recovery is due to their power of absorbing water by their leaves—a power which is absent or which only exists to an insignificant extent in most of the higher plants. Hence less work falls on the conducting tissues of the stem than in the latter, for only a small part of the water supply is taken up from below, though this part of the supply is important as it carries with it the necessary mineral food substance." [1]

Fig. 9. Moss.

Look again at the Moss which you have in your hand. Can you see those long thin stalks each bearing a nodding pear-shaped case? These are the fruits of the plant, and contain the spores. When the case opens, the spores are scattered by the wind, and if they be successful, something like this happens: the spores germinate and produce simple threads; these give rise to buds which, in their turn, produce the new plant.

[1] *Flowerless Plants*, by D. H. Scott.

Curiously enough, Mosses resort to other methods of reproducing themselves. In some species the roots and the leaves have the power of forming "buds"—somewhat similar to the bulbs of the higher orders—and from these the new plants spring.

A few words must be said with respect to their uses. They may be described as forerunners, for they precede and pave the way for their more important brethren. Bogs have been filled up by their agency; year in and year out their growth and decay have improved the soil by adding to it vegetable mould sufficient for the nourishment of plants of a higher organisation; even a bare mountain side may thus become the site of a flourishing forest, which could never have existed there, but for the patient work of the humble Moss.

Fig. 10. Liverwort.

Ruskin beautifully describes them as "The first mercy of the earth, visiting with hushed softness its dintless rocks. And, as the earth's first mercy, so they are its last gift to us: when all other service is vain from plant and tree, the soft Mosses and grey Lichen take up their watch by the head-stone. The woods, the blossoms, the gift-bearing Grasses, have done their parts for a time; but these do service for ever. Trees for the builder's yard, flowers for the bride's chamber, corn for the granary, Moss for the grave."

A little lower down in the scale of plant life are the Liverworts, many of which show no distinction of leaf and stem, but consist of bodies performing the function of both these organs. Usually they grow by the sides of brooks or in damp woods, sometimes actually living under water.

Like the Mosses, they do not possess true roots, but

such as they have fix them to the ground. When the plants begin their new growth in the Spring, a great number of small crowded branches are sent out, giving the growing edge a parsley-like appearance.

V.—TREES BY THE STREAM

OLD FRIENDS—THE ASPEN—LICHENS

As we journey along our stream, we cannot help being struck by the large variety of trees that shade its waters. Some seem out of place, as though they had taken up their abode there more by chance than by choice; one can fancy them longing for the more congenial soil and atmosphere of the meadow, the hedge, or the wood.

Others—and these are in the majority—are quite at home, and appear to caress the beloved water with their delicate leaves and branches.

Among this second class we shall surely find some, if not all, of our old pond friends, the Alder, the Willow, and the Poplar to wit. These are, indeed, the companions of the stream, and are never seen to better advantage than when growing in the neighbourhood of still or flowing water.

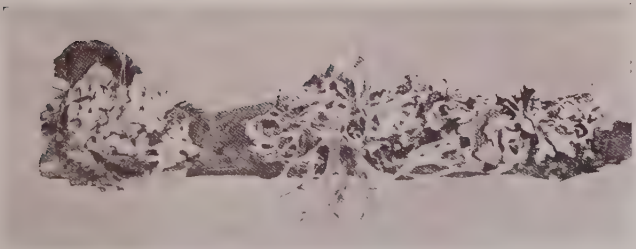
For grace and beauty it is difficult to find a rival to the Aspen, one of the children of the great Poplar family.

This soft-wooded tree will secure a foothold in almost any soil, but it is in the moist lands that it flourishes best and arrives at perfection.

In March or April the leafless grey boughs are covered with catkins—those long fluffy tails so characteristic of the Poplars. Those which bear the pollen have bunches of

LIVERWORT.

MOSS.



LICHEN ON TWIG.

A. COMMON RUSH. A¹. SINGLE FLOWER.
B. GREAT SEDGE. B¹. SINGLE MALE FLOWER.
B². SPIKELET, showing Male Flowers at top and Female Flowers at base.

purple-headed stamens arranged along their spikes, each bunch being protected from wind and rain by a jagged scale. The other catkins, though similar in appearance, bear the seed, and search should be made for a seed vessel, which resembles " a small green pea sitting in a tiny green cup."

When the leaves appear, they are rounded in shape and have toothed edges; their stalks are long and flat, and thus it is, at the faintest breath of the wind, a quivering movement is set up among the leaves, producing that rustling sound which harmonises so well with the song of the brook.

Fig. 11. Leaf and Catkins of Aspen.

Throughout the Summer and Autumn the tree continues in this state of agitation. Our forefathers have explained this in their usual quaint fashion by suggesting that the cross on which the Saviour was crucified was hewn from the Aspen, which, horror-stricken, has ever since shown the signs of its terror and grief.

Its roots have a tendency to keep near the surface of the ground, and they impoverish the soil to such an extent that few plants can flourish in its immediate vicinity. These roots send up young shoots or suckers, and, strange to say, the leaves, which they bear, differ from those on the main branches in so far as they are heart-shaped and do not possess toothed edges.

Many an Aspen has come to an untimely end through the excavations of the Goat Moth larvæ, that find in its soft wood an excellent material in which to bore their tunnel-like homes.

Growing upon the bark of the trees fringing our stream,

and also upon the rocks, that are for ever splashed with its waters, are curious growths, which, at first sight, we are inclined to regard as Fungi. These are the Lichens, and they, unlike the Fungi, neither live upon the dead nor attack the living.

A Lichen is a compound organism, consisting of a Fungus and numerous Algæ; it is thus described by Dr. Frank Cavers in *The Book of Nature Study* :—

" The Fungus, composed of branching and interlacing threads, has grown around the Algæ, and enclosed them in a sort of nest. The result is that the Lichen can grow in places which would be quite unsuitable for the independent existence of either the Fungus or the Algæ of which it is composed.

" Algæ grow in water or in moist places, and very few can live without a regular and abundant supply of water, while (apart from the leathery and cakey Bracket Fungi) Fungi are, beyond most other plants, sensitive to cold and drought. . . . Yet Lichens can thrive in the bleakest positions and in the most severe climates . . . or where they are exposed to the greatest extremes of heat and of cold."

Like the Mosses, the Lichens are the pioneers of vegetation; they are the first to appear on cooled lava or newly elevated coral reefs, and by their action the hard rock is slowly broken up, and a thin layer of soil produced.

VI.—BIRDS OF THE WATER-SIDE

REED BUNTING — MUTE SWAN — KINGFISHER — SEDGE WARBLER — GREY WAGTAIL — HERON — BIRDS WHICH COME TO DRINK

Among the birds that may be met with by the stream, the Reed Bunting cannot fail to arrest attention. The male may at once be distinguished by its black head and throat, white breast and collar, and also by its scratchy little song. This is a kind of harsh chatter, and as the bird is of a lively disposition, its notes are sure to attract more than ordinary notice, though they possess little variety. The female has a reddish-brown head instead of black.

Fig. 12. Head of Reed Bunting.

Wherever Reeds and Sedges fringe the stream-side, or where Osiers abound, there search may be made for the nest; this is composed of moss, dry grasses, reed-stems or leaves, with a lining of fine grass, reed flowers, and hair. The four or five eggs are ash-coloured, boldly marked with jet black streaks in the manner so characteristic of the Bunting family.

But there are large as well as small feathered folk which inhabit our waters, and yonder Swan, swimming so majestically, is certainly entitled to some consideration. This is the Mute Swan, and is the only species of Swan that nests in a wild state in this country.

Most of these graceful birds are semi-domesticated, although they are at all times somewhat ferocious looking, and hate to be disturbed in their favourite haunts. Whatever spot they frequent they distinctly ornament, for their

snowy-white plumage and beautiful movements are such as to attract notice and comment. A pair of these Swans have tenanted our stream for many years, and early in each Spring a huge nest of Rushes and Reeds is built.

In this large flat structure, six or seven green eggs, about the size of a small Rugby football, are laid, and when the female is sitting, the male bird ably protects her by warning off intruders in a manner calculated to strike terror into the heart of the unwary and too venturesome. The young are known as Cygnets, and very pretty little Swan babies they are.

The stream is one of the favourite homes of this graceful bird, for here it procures its living, feeding upon water plants of various kinds, as well as upon insects; tiny shellfish also form part of its diet, but these are probably swallowed quite accidentally.

When rambling by the water-side, it is as well always to keep a sharp look-out for the most beautiful bird we have in Great Britain, to wit, the Kingfisher. Unless you are fortunate enough to catch this bird fishing, your quest may prove in vain, for it will dash by before you are aware of the fact. Sometimes, when the patient angler goes a-fishing, he has good opportunities of observing this lovely creature; it has been seen to fly rapidly down stream, hover suddenly in the air like a large green and orange-red butterfly, and then make a plunge at some fish, which were bathing their bodies in the sunlight. It is a splendid fisherman, and obtains far more sport than the keen disciple of old Izaak Walton sitting on the bank waiting for a bite!

With plump little body, short tail, large head, and dagger-like beak, the Kingfisher may sometimes be seen sitting on the bough of an overhanging tree, or on a neighbouring post or railing. He looks like a little old man as he

sits there without the slightest movement; but, all of a sudden, he espies his prey in the water, dashes headlong into the stream, procures a fish or two, and flies off to his young ones further down the river.

To find the nest is not an easy task. Search should be made in holes along the bank, but sometimes the tunnel made by a Water Vole or a Sand Martin is chosen. In the dark recesses of the home Mrs. Kingfisher deposits from six to eight beautiful glossy-white eggs, the nest itself consisting of the bones of small fish!

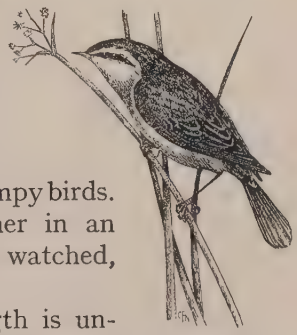


Fig. 13.
Sedge Warbler.

The young ones are quite unlike their handsome parents—for both the father and mother are equally beautiful—being curious-looking, stumpy birds. When observed, they huddle together in an extraordinary way, hating to be watched, much less interfered with.

To describe the plumage at length is unnecessary; the remarkable mingling of azure-blue and bluish-green on the back and head, the white throat, the orange-red under parts, and the red band under and behind the eye, being such that nothing short of a long, detailed description would do justice to it. The bird measures about seven and a half inches in length.

As we wander along the stream, peeping into the rushes as we go, we suddenly disturb a small brown bird which at once shows its resentment by uttering a passionate song, that seems as if it is sung to the listener! Throw a stone gently into the herbage, and the little rascal will sing with increased vigour. Now and again the notes of other birds may be distinguished in its song; in fact, it is something of

a small Mocking Bird that we are listening to. What, then, is it?

It is a Sedge Warbler, a Summer migrant to our country, which arrives during late April, and at once sets up a chattering by the stream to let all his friends know that he has arrived after a safe journey.

Try and get a sight of the restless creature. More easily said than done, for the bird manages to be close at hand and yet well hidden. Could you see him—and you may do so if you wait long enough—it would be noticed that his whole body is agitated, and one wonders why the excitable Warbler should be so cross at our having quite unconsciously disturbed him.

Fig. 14.
Nest of Sedge Warbler.

You may know him by a prominent broad streak of yellowish-white over the eye; otherwise he is grey-brown above, with a white throat and pale buff underneath.

Among the Rushes, or in a thick low bush, the neat nest may be sought for; it is made up of the stems of plants, coarse grass, moss, hair, and fine grasses. It is a somewhat deep home, and the five or six pale brown and pointed eggs occasionally have a thin dark streak upon them.

Some country people call this the Mock Bird, a name that is, for a wonder, not altogether misapplied.

You will remember when visiting the pond, we watched a black and white bird which flirted his tail so gracefully, that we identified him as the Pied Wagtail. See, there by the old waterfall yonder is a bird of similar habits, but grey and yellow in colour. That is the Grey Wagtail, which

delights in placing its nest near water, for it finds abundant insect food there. If you see the bird in Summer, you will notice that it has a black throat, but in Winter this gives way to whitish-yellow. The eggs of this Wagtail are smaller than those of its relative we met at the pond, and are pale French-grey, mottled with faint creamy-brown.

The Kingfisher is not the only feathered fisherman that haunts the stream, for occasionally the Heron may be found there. And why does he come from his stick-like

Fig. 15. Grey Wagtail.

home in the tree tops? For the purpose of obtaining food for his young ones. Standing in the water with his long stilt-like legs, the Heron is able to wade into the shallows.

There he stands with shrugged shoulders, sometimes with his eyes half closed. But, should a Water Vole venture too near, or a Frog, or a shoal of fish, then the wary bird rouses from his lethargy, snatches at and secures his prey by means of a great strong beak as sharp as a bayonet, and rises slowly. Finally, the bird sails away on majestic wings well satisfied with the result of his labours; for has he not secured food for his ungainly little ones, which are eagerly anticipating the feathered fisherman's return?

On a hot Summer's day an interesting time may be

spent by a stream watching the various kinds of birds which visit the water for the purpose of quenching their thirst. Birds, it should be noted, are more fond of drinking than many people give them credit for, and it has been observed that in a dry season fruit is greatly relished by some feathered choristers which, during a rainy Summer, do not trouble the fruit-grower to any appreciable extent.

By quietly sitting down and carefully watching, it is possible to make a series of notes concerning some birds which come out into the open from their hiding places in the trees, hedgerows, bushes, and woods, where the thick foliage largely shields them from view. The gay Chaffinch, for example, whose mossy cradle is secreted in a blossoming thorn-bush, pays the stream a visit, and with that happy gait for which it is so famous entertains the looker-on by its active manœuvres.

Fig 16. Head of Heron.

The Greenfinch—a voracious feeder at all times—also finds out the shallow part of the water, and very frequently quite a small collection of British birds gather together, which makes watching them a pleasure. Sometimes they bathe their bodies in the stream, and ragged-looking mites some of them are after partaking of a bath, especially if they happen to finish off the performance by dusting themselves in the road! In this way they dry their bodies!

Our friend the Common Sparrow, and also the Skylark, are very fond of thus attending to their toilets.

The handsome Song Thrush and the sober Blackbird will also come to the stream to drink, and very often the speckled Starling ceases hunting for grubs in the meadow bordering the water and slakes its thirst.

Female Reed Bunting at Nest.

Nest and Eggs of Reed Bunting.

MUTE SWAN.

YOUNG KINGFISHERS.

VII.—TWO AQUATIC MAMMALS

WATER VOLE—WATER SHREW

PLOP! That was all we heard, but it was sufficient to indicate that Tim, the Water Vole, had taken a plunge into the stream. He had just been feeding on the green grass which covers the bank, but as we approached he felt it would be more secure to dive into the water and swim to the other side.

If we wait long enough, we shall see him, for already bubbles are arising in mid-stream, showing that the Vole is near the surface so as to breathe better. Look! There he goes! Do you see him with his head above water, sniffing now and again? His little black eyes and whiskers are now quite plain. At last he has reached the opposite bank, and as he sits there in the sunshine nibbling at some more grass, he looks, does Tim, quite a little picture of his own. He is still very busy feeding, and must surely be rather hungry this morning. Clap your hands after watching him closely.

Fig. 17. Head of Water Vole.

Plop! He has dived into the stream again, but this time he swims along the side, and at last clambers up the bank into his hole. What a clean, well-groomed little animal this is, so very different to the detestable Brown Rat, and in his greyish-brown fur, tinged with red, he is one of the nicest little creatures to be met with on the banks of our stream. He reminds one of a little Beaver, and it is distressing to hear people so frequently refer to him as a Water Rat!

That the Water Vole is a vegetarian we have long since

agreed; but most unfortunately the ravages of that harmful pest, the Brown Rat, are often in ignorance attributed to the Vole, whose entertaining habits we have been watching.

When he was sitting up on his haunches feeding off the opposite bank, did not Tim remind you of a Squirrel? Beaver-like, Squirrel-like, but certainly not Rat-like, what an interesting little animal that " plop " revealed to us! It does not always feed thus, but when it does, our interest cannot fail to be aroused.

During the early days of Summer, five or six little Voles are born in a nest made up of dry Grass and other herbage. The morning and evening see this animal at its best, for then it is that food is mostly secured, and if one is fortunate enough to come across a number of Water Voles busily feeding and swimming—and some parts of the bank of our stream are quite riddled with their holes—it is one of the happiest sights to watch the active creatures at their work and play.

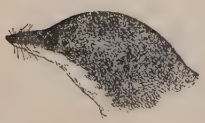


Fig. 18. Head of Water Shrew.

We may, after a careful search, find still another interesting mammal along our stream, and this is the Water Shrew, first cousin to the Common Shrew that we met with in the meadow.

It makes its home in a long, winding tunnel by the river, but also resorts to ponds, ditches, and similar places. It is a clever digger, and at the end of the lengthy burrow a nest is made of dry Grass and Moss. Here, during the merry month of May, when the Hawthorn is well in bloom, from five to eight young ones are born.

What kind of animal should you look for, do you think? It is subject to a good deal of variation, but is generally black and white. When in the water, however, it appears

grey, this effect being caused by small bubbles of air that cling to the fur; indeed, these often give the Shrew quite a silvery appearance. The length of the head and body is about three and a quarter inches, and the tail about two inches. The feet are white, and the tail has a stiff fringe of white hairs.

This Shrew is entirely aquatic in its habits, and is a superb diver and a splendid swimmer. It swims easily and silently, and if ever you are lucky enough to find it feeding at the bottom of a clear brook, you can promise yourself rich entertainment. Water insects of various kinds as well as Fresh-water Snails and Shrimps constitute its food, but the animal is accused, and probably with reason, of eating spawn and young fish. Dead animals are also, it is said, partaken of.

VIII.—FRESH-WATER FISHES

TROUT—DACE—MINNOW—GUDGEON—RIVER EEL—STICKLEBACKS

Some kinds of fish are fonder of running water than that of a pond, and in the stream we shall find the beautiful Trout, whose greatest delight is a clear-running brook with a gravelly bed. The Trout is entitled to pride of place among the fishes in our stream, for it is a handsome species and belongs to the Salmon family.

Trout differ a good deal in colour and markings, and it is often difficult to tell exactly the correct name of a given species, there being so many of these fish reared artificially, the result of which is that many *varieties*, and not distinct

species, are forthcoming. Some may be observed, for example, bronze-brown; some silvery-pink spotted with red; some very dark and almost black. The general colour is green or brown, spotted with red or black.

A quick swimmer, a magnificent sporting fish, a great feeder, these are the characteristics of a Trout; and if the reader happens to be by a river when the Mayflies are rising from their watery home, then is the time to search for a large Trout, and watch him greedily devouring the insects as they dance on unsteady wings down stream. Notice that the fish are invariably seen with their bodies facing up stream. There is reason for this, for not only is food more easily procured in this way, but water is thus carried through the gills. By means of the latter a fish breathes, it of course having no lungs like human beings and other animals.[1]

The life-history plate will give a good general idea of the wonderful story of a Fish as revealed to us by a study of the Rainbow Trout: firstly, the ovum or egg; then the young fish, or Alevin, as it is called; and lastly the perfect little fish. When it is twelve months old, or a yearling, it is about three inches in length, but long before that time it is a perfectly formed fish in every way.

When an Alevin, you will observe that the little stranger has a conical bag suspended under the belly. What purpose does this serve? It is a bag containing the red yolk of the egg, and during the first few weeks of the little one's life, this yolk forms the food upon which it feeds, for although the eyes are by then quite well developed, the mouth is only slightly so.

Being voracious in its habits, and obtaining an abundant food supply, the Trout soon makes up for lost time when it

[1] See *The Pond I Know*, p. 72.

does begin to increase in size. It often attains a weight of several pounds, and then affords rare sport to the angler, being a splendid game fish. It is said to live for over thirty years.

Do you not see a shoal of beautiful silvery fish disporting themselves near the surface of the water? Every now and then one of the little fellows darts clean out of the stream and shimmers in the sunshine like living silver. These are Dace, and may be easily distinguished from the Roach we found in the pond by their smaller size and absence of dark colour. They greatly prefer running water to the stagnant pond, and here they flourish abundantly, travelling about in shoals. Curiously enough they are not found either in Scotland or Ireland.

The general colour is almost silvery blue over the whole body, and the weight rarely exceeds more than one pound. Insects and various kinds of vegetable matter constitute the food; the spawning season is May or June.

Another small fish that inhabits our stream in large companies is the Minnow, one of the most beautiful little fish it is possible to imagine. It averages about four inches in length, and thrives splendidly in fast, clear-running waters. If a specimen be examined, it will be found to be dark green in colour with black along the back. It is silvery below, and the fins on the breast have a red tinge. Like some other animals which lead an aquatic life, the Minnow has the power of changing colour rapidly; the act is probably an unconscious one, but is made possible by there being more than one row of pigment cells just beneath the skin.

At the bed of the stream—and rarely elsewhere—one may find the Gudgeon, charming little fish that also live in companies. It is a lover of the river-bottom, and may at

once be distinguished by having, like the Tench in the pond, two barbels upon the jaw. It is grey in colour, marked with dark brown.

The Gudgeon lives on insects, but has curious feeding habits, as those who have angled for it can amply testify. Numbers of these fish will permit a tasty bait to drag right over their bodies without making any effort to snatch at it, but when they come "on the feed," as anglers remark, they are very voracious, and it is possible to catch almost the whole shoal.

All the finny tribe so far referred to may be seen from the bank of a stream when the water is clear, but one must in any case proceed very cautiously, for fish are easily frightened. The rambler is not likely, however, to see the River, or Fresh-water, Eel, for it is a lover of the deep, muddy bottoms, and, except when it is thundery, rarely seems to come out into the open parts of the stream.

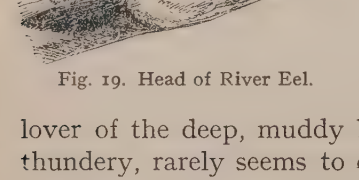


Fig. 19. Head of River Eel.

Could we see the Eel, we should find that it is somewhat Snake-like in appearance, and slippery to the touch, caused by very small scales with which its body is clothed. It is brown or green above with white or yellow below. The eyes and teeth are small, but the latter are very sharp. The head is long and pointed.

Young Eels, called Elvers, are like small pieces of dark thread, and it seems remarkable that these fragile little creatures eventually grow to be three feet long.

It is said that in the Autumn the female River Eel leaves our stream and makes her way to the sea for spawning purposes, even travelling overland if necessity demands

it. Observers have recorded that, as Winter approaches, young Eels are seen ascending rivers from the sea. There is, however, a good deal still to be learned concerning these remarkable inhabitants of our fresh waters, and a careful study of their habits would probably reveal many interesting points at present unknown.

The fish we have so far mentioned deposit their spawn just where it best pleases them, but there are some others in the stream—known to every one as Sticklebacks—which do not resort to this method, but actually build a neat little nest that would do credit to a good many birds.

Fig. 20. Three-spined Stickleback and Nest.

This barrel-shaped nest, which is the entire work of the male, consists of grass and stems cemented together by sticky threads obtained from the kidneys. Into this charming home the owner entices a female, who, having deposited her eggs, proceeds unconcernedly on her way. These eggs the male fish guards with jealous care, attacking every enemy that comes within reach.

The three kinds of Sticklebacks figured in the illustrations are known as the Three-spined, Ten-spined, and Smooth-tailed species.

The reason for these names is obvious, for the first species has three, and sometimes four, spine-like projections on the back, the second has ten spines, and the third has a smooth tail.

Beloved by boys who go a-fishing with net and bottle, or string, bent pin, and a tasty worm, the Stickleback is a most interesting little fellow, and more worth watching than catching. The male—called a Soldier—is a gay creature

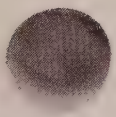
in the breeding season, being adorned with red and green, and having bright eyes that glow with anger when his nest is approached too closely. He may be seen guarding the entrance to his home, and nobody is permitted to enter the portals except females who are willing to lay eggs therein. The nest is usually well hidden among water weeds. It is a small tangled ball of herbage, and it is pleasant to observe the pride taken by the male in his homestead and his exciting chase of would-be robbers.

The body of a Stickleback is clothed with bony plates in the place of scales, and these vary in number. Green, silver, and brown are the colouration, but the male, as mentioned, is adorned like a gay little red soldier during the breeding season. Various kinds of water insects, as also Fresh-water Shrimps, and many other minute animals, are fed upon by this inhabitant of our stream. There he passes the long Summer days, and if rather than catching him and transferring him to a stuffy bottle, it is decided to study his habits—even if at a disadvantage—much will be learned that would otherwise escape notice.

IX.—WATER INSECTS AND RIVER CRAYFISH

CADDIS FLY—MAYFLY—WATER MEASURER—GNATS—RIVER CRAYFISH

In the stream, as in the pond, there is a large variety of animal life hidden from view, and it is only as a result of exploring in the water, that any real idea can be obtained of the remarkable creatures which make the stream their home.



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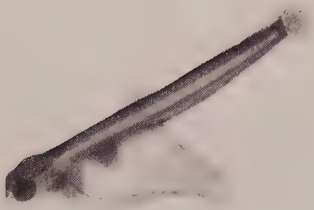

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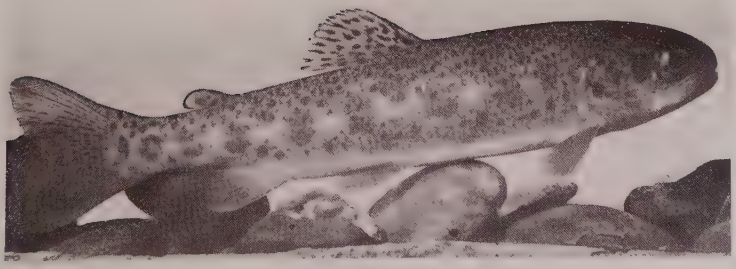

4

Life History of Rainbow Trout.

1. Egg enlarged.
2. Egg Hatching.
3. Young Trout with Yolk Sac.
4. Perfect little Trout a Year old.

Water Vole.

Water Shrew.

Several of the little pond people will be here, too, for one is a copy of the other to a very great extent; we had better, therefore, make a selection from among these insect folk, and learn to know a few of them really well rather than a little about a good many.

If it be a nice day, and the water be clear and bright, peep into the stream where it is somewhat shallow, or fish out an old stick or stone. You may then make the acquaintance of the larva of the Caddis Fly.

Fig. 21.
A. Caddis Fly.
B. Larva out of case.
C. Larvæ in cases.

Some of the curious little creatures may be seen crawling about the bed of the stream, but let us obtain a specimen and examine it. At length one is secured, but we find that the larva has retired inside the front door of its home, and refuses to come out again, no matter how pressing the invitation may be. See, the case in which the larva is so comfortably housed is made up of pieces of stick, leaves, and other materials, moulded together in a very ingenious way. If we secure another specimen or two, probably on an old stick or log that has been lying in the water for some time, we shall find that there are various kinds of houses built by these creatures.

Here is one, for example, composed of tiny portions of sand, and at one end there is a little shell as if placed there for ornamentation, much after the manner of the porch we build over our own front doors! Other specimens may be met with upon which small shellfish may be found sticking as firmly as glue; these and the owner of the house must needs travel about in company.

There are several species of Caddis Flies, and it would be an interesting operation for the student of aquatic life to pay special attention to the various kinds and the different homes they build.

But how come these remarkable little animals here, and what is their history? The female Caddis Fly lays her eggs either in the water or upon stones or plants hard by. They are not unprotected even then, being wrapped up in a sort of sticky envelope; a few days after being deposited they hatch.

The small babies stay in this environment some little time before daring to explore the mysteries of the stream, and it almost seems as if the tiny mites realised that, unless some sort of protection were adopted, they would stand very little chance of escaping from numerous enemies. Hence, in due time, the larvæ build the wonderful homes we have seen, and great skill is displayed in fashioning them; indeed, it has been found that no matter what material is used, the homes are usually of "the same specific gravity as the water, so that the worms have no difficulty in moving from place to place." The tiny fragments of sticks, leaves, moss, stones, seeds, rushes, sedges, shells of molluscs, etc., are fastened together by means of a sticky substance which, when exposed, hardens into a kind of silk.

If one tries to dislodge a larva from its home, it will be observed that the creature does not care to be so evicted. It clings tightly to its case, and is aided in this by means of little hooks situate at the end of the body, also by the help afforded by the third pair of legs, and in some species by three small humps.

It is interesting to see the little builder engaged constructing a home, and if one is taken from its shelter and placed in water with suitable building materials, it will con-

struct a new homestead in less time than it takes a human being to make a rough and ready rabbit hutch!

In this home, then, the yellow fleshy larva resides, and when the time comes for it to change into a pupa, it closes the entrance to the front door, enters into the chrysalis state, and eventually comes out triumphant as the perfect Caddis Fly.

But see, the surface of the water is literally covered with the airy forms of a frail-looking insect, with wings like thin wire gauze, and three long processes like the tails of a kite upon the extremity of the body. You remember what was written of the Trout in an earlier chapter, how the fish loved to feed when the Mayfly was rising?

Fig. 22. Mayfly and Larva.

These, then, are Mayflies, just emerged from their watery home. One of the most remarkable points concerning them is the short period the adult insects live after passing through their wonderful change. Sometimes they exist as perfect insects for a few hours only, "being born, so to speak, after sunset and dying before sunrise; while the longest livers, the patriarchs of the family, exist but for a day or two as a rule, though in captivity it is said that they have been kept alive for a week or even more."

The alternative name of Day Fly indicates that the life of the perfect insect is limited to a day; nevertheless the larvæ enjoy an existence of anything from one to three years.

If an adult specimen be examined, you will find that there may be one or two pairs of wings. The hinder pair,

if present at all, will be observed to be much smaller than the front pair.

And yet, although the adult insects live for so short a time, the females manage, during their restricted sojourn on and around the bosom of the stream, to deposit small oval eggs in the water, and thus make sure that the species shall be continued. When the eggs hatch, the flat larvæ have three feathery appendages on the abdomen, long and bristle-like antennæ, and strong mouths. They do not build a tube like the Caddis Worm, but live unprotected in the open water or in U-shaped burrows along the bank. And why is the burrow so shaped, do you think? So that the larva can go in at one hole and out at the other without having to turn right-about-face!

As it grows, the larva changes its skin many times, and as the wonderful transformation proceeds, the pupa develops slowly but surely. Then, as a pupa, the creature leaves the water and at last turns into a Fly. It is not yet, however, the perfect little gem we have been watching, for it has still to undergo another moult. It clumsily settles upon some inviting spot, and contrives to say good-bye to its old covering; then it is that the lovely little Mayfly emerges, and if a careful search be made on the herbage by the stream during the month of May, the empty skins, almost perfect in shape, may reward the searcher.

Curious to relate, the perfect Mayflies usually come out towards sunset and all about the same time. The male may be distinguished upon the wing by its noticeable up-and-down flight, and also by having larger eyes and longer tail-filaments than its mate.

As we stand on the old weather-worn bridge across the stream, we obtain a good view of a large number of long black insects, possessors of very long thin legs, and they are

all skidding or skating on the surface in a most curious way. What, then, are these? They are called Water Measurers, and are near relatives of the Water Scorpion that we found in the pond.

With long black body and long limbs, does not this curious creature remind you somewhat of the structure of the Daddy Long-legs we found in the meadow? To catch the Water Measurer is more easily said than done, for it is very quick in its movements, and is a marvellous adept at clinging to a water weed. So little does it look like an insect when thus found, that it could be quite easily overlooked.

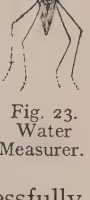

Fig. 23. Water Measurer.

It is a splendid hunter, lying in wait for its prey, and then shooting out its two front legs and securing its victim in the folding joints, "which shut down just like the blades of a pocket-knife." Not only are insects captured in this way, but even our little friend the Stickleback is sometimes successfully attacked.

A fierce, bold inhabitant of our stream, the Water Measurer possesses a "beak" which aids it considerably in sucking the blood of its victim. A close examination of a specimen will reveal a body covered with a velvety pile, which renders it incapable of being wetted. There are also a pair of long and narrow wing cases, under which the wings are situated; by means of these the insect can, if it chooses, fly from one part of the stream to another, or over the hills and far away to some sequestered pool.

There are at least nine different species of Gnats in England, and of these two or three are very fond of visiting our houses. The female of the Ring-footed Gnat is capable of inflicting a nasty "nip," but it should be noted that it is only the female which "bites."

Few people seem to regard Gnats as either useful or interesting insects, but let us search for a specimen by the stream and see what we can discover concerning them.

Keep a sharp look-out where the water is fairly still; among the rushes the force of the stream is checked, and it is there we may find the Gnat at home. The adult insects, it is true, come out into the open and dance merrily over the surface of the rippling stream, and a happy little company they are. The larva and pupa, however, must be sought for where the water is in no hurry to rush onwards towards the sea.

Fig. 24. Gnats.
A. Male. C. Larva.
B. Female. D. Pupa.

The slim-bodied male may be distinguished from his mate by the plumed or feather-like antennæ, and whilst the female is also plumed her mate successfully out-rivals her in this respect.

It is curious to notice that, whereas Mr. Gnat largely lives on the nectar of flowers, Mrs. Gnat resorts to sucking the blood of animals, including man!

Could we discover a female egg-laying, we should witness a curious performance, for she deposits her eggs by settling on a piece of floating stick or herbage. Then she arranges herself in such a way that egg after egg is laid and collected whilst she is comfortably seated on her raft, until from 200 to 300 are all fastened together by a sticky substance. The eggs are so placed that the narrow ends are at the top, and the whole collection forms a sort of boat, which floats beautifully, being remarkably buoyant and self-righting. Even if pushed forcibly below the water the insect " lifeboat " will rise to the surface and float again!

After a few days in the water the eggs hatch, a kind of front door opening at the lower end and setting free the larvæ. Each larva has a somewhat large head, a large thorax, and a long body, and on the eighth segment there is a small tube which represents the breathing apparatus. This tube is thrust out of the water when the creature requires a fresh supply of air.

Where the water is stagnant these Gnat larvæ are of service, for they feed upon various decaying matter, and so help to cleanse the stream or pond in which they live.

The pupa is very different from the larva, having what on first sight appears as an enormous head, but which in reality is the head, thorax, wings, and legs of the future Gnat fastened up in a sort of envelope. The pupa, too, differs from the larva in floating head uppermost, as its two horn-like breathing organs are situated at the back of what we may call the head.

As time goes on, the little wanderer comes more frequently to the surface, exhibiting a desire to proceed upwards to the unknown world beyond, and when eventually the day of transformation arrives, it stays at the surface and remains motionless. Slowly but surely the body gets lighter in weight, until at last the skin splits and the perfect Gnat is revealed. Then the insect will rest for a while on the old pupa skin, using it as a raft on which to float until it is in a fit condition to join its brothers and sisters and dance merrily upon the wing.

Perhaps you can hardly imagine that our stream is inhabited by large numbers of a small Fresh-water Lobster! Yet such is the case, and sometimes baskets-full of this interesting little creature are captured and sold for the table. It is really called the River Crayfish, but it is

certainly not out of place to refer to this inhabitant of our stream as a Fresh-water Lobster.

And how do you think this animal is enticed to enter nets sunk in the water? It is a great lover of raw meat, and if the net is thus baited, it proves too tempting, and lo! Master Crayfish finds himself a prisoner. It is green in colour, but, like the Lobster, turns to a brilliant red when boiled.

Where a stream is found with a good gravelly or rocky bed, there this creature may be sought for. The young are produced from eggs laid in November and December, and they are very much like the adults, an important point worthy of notice, as this rule does not hold good with many of their relations. And where do you think the eggs are placed? They are actually fastened to the mother's hind legs with a kind of glue, and are there carried until they hatch the following May or June.

Fig. 25. Head of Crayfish.

The River Crayfish, like its marine cousins, casts its shell, for, as the animal grows, it is necessary that the outer covering should also be enlarged. It has been observed that, when the old shell is about to be shed, the Crayfish loses its appetite, and this results in the body shrinking; thus the moulting process can be better performed.

Is it not remarkable to notice, when examining a cast-off shell, that the exact reproduction of the living creature is to be seen, even the eyes and antennæ being observable? After the old case has been thrown off the animal appears considerably exhausted; its body is then soft to the touch, and far different from the horny coat of mail that has been cast off. Soon, however, the outer covering hardens, the

Dace.

Minnow.

GUDGEON.

THREE-SPINED STICKLEBACKS.

creature regains its appetite, and in a very short time it is again well protected by its armour.

The food of the Crayfish is made up of worms, insects, molluscs, and dead animals; it is usually during the night, when lying at the mouth of its hole or burrow, that prey is secured.

X.—NOT LOST BUT GONE BEFORE

A PARABLE OF THE DRAGON FLY

It has already been mentioned, wherever there is water one may chance upon certain kinds of animal life; and whether it be pond or stream, there, sure enough, during the bright days of Summer one may espy the Dragon Fly.

In *The Pond I Know* attention has already been given to the life-history of this insect-dandy, but before we leave the stream, shall we endeavour to learn something further about this remarkable creature?

For this purpose, there is set out below a beautiful tale written by Mrs. Gatty, who died in 1873. This clever woman wrote many charming stories, but none perhaps that appeal more to readers of this book than her *Parables from Nature.*

No apology is needed, therefore, for introducing here one of the wonderful parables from Mrs. Gatty's book, which will, it is hoped, make a strong appeal to young people. It tells of a Dragon Fly nymph which, unlike his brethren, wondered what was beyond the watery element in which he lived; many were the hours spent in thinking and talking about this subject, until at last the spirit of inquiry spread among the others.

Then came the time when the nymph must leave his old playmates and climb up the weeds to the unknown land. Sorrowfully his friends gathered around him, and many were the promises begged and granted. Thus the story proceeds:—

" Promise! " uttered an entreating voice.

" I promise," was the earnest answer.

" Faithfully? " urged the first speaker.

" Solemnly," said the second.

But the voice was languid and weak, for the Dragon Fly Grub was sick and uneasy. His limbs had lost their old activity, and a strange oppression was upon him.

The creatures whom he had been accustomed to chase passed by him unharmed; the water-plants, over which he used to scramble with so much agility, were distasteful to his feet; nay, the very water itself into which he had been born, and through which he was wont to propel himself with so much ingenuity, felt suffocating in its weight.

Upwards he must go now, upwards, upwards! That was the strong sensation which mastered every other, and to it he felt he must submit, as to some inevitable law.

His friends and relations were gathered around him, some of his own age, some a generation younger, who had only that year entered upon existence. All of them were followers and adherents, whom he had inspired with his own enthusiastic hopes; and they would fain have helped him, if they could, in this hour of weakness. But there was no help for him now, but hope, and of that he possessed, perhaps, even more than they did.

Then came an earnest request, and then a solemn promise, that, as surely as the great hopes proved true, so surely would he return and tell them so.

"But, oh! if you should forget!" exclaimed one of the younger generation, timid and uneasy.

"Forget the old home, my friend?" ejaculated the sick Grub, "forget our life of enjoyment here, the ardour of the chase, the ingenious stratagems, the triumph of success? Forget the emotions of hope and fear we have shared together, and which I am bound, if I can, to relieve? Impossible!"

"But if you should not be able to come back to us," suggested another.

"More unlikely still," murmured the half exhausted Grub. "To a condition so exalted as the one in store for us, what can be impossible? Adieu, my friends, adieu! I can tarry here no longer. Ere long you may expect to see me again in a new and more glorious form. Till then, farewell!"

Languid, indeed, was the voice, and languid were the movements of the Grub, as he rose upwards through the water to the Reeds and Bulrushes that fringed its bank. Two favourite brothers, and a few of his friends, more adventurous than the rest, accompanied him in his ascent, in the hope of witnessing whatever might take place above; but in this they were, of course, disappointed.

From the moment, when, clinging with his feet to the stem of a Bulrush, he emerged from his native element into the air, his companions saw him no more.

Eyes fitted only for the watery fluid were incapable of the upward glance and power of vision, which would have enabled them to pierce beyond it; and the little coterie of discoverers descended, mortified and sorrowful, to the bed of the pond.

The sun was high in the heavens when the Dragon Fly Grub parted from his friends, and they waited through the

long hours of the day for his return; at first, in joyful hope, then in tremulous anxiety, and, as the shades of evening began to deepen around, in a gloomy fear, that bordered at last on despair. "He has forgotten us," cried some. "A death from which he never can awake has overtaken him," said others. "He will return to us yet," maintained the few who clung to hope.

But in vain messenger after messenger shot upwards to the Bulrushes, and to various parts of the pond, hoping to discover some trace of the lost one. All who went out returned back dispirited from the vain and weary search, and even the most sanguine began to grow sick at heart.

Night closed at last upon them, bringing a temporary suspension of grief; but the beams of the next rising sun, while it filled all Nature beside with joy and hopefulness, awakened them, alas! to a sense of the bitterest disappointment, and a feeling of indignation at the deception which had been practised upon them.

"We did very well without thinking of such things," said they; "but to have hopes like those held out, and to be deceived after all—it is more than we can be expected to bear in patience."

And bear it in patience they did not. With a fierceness which nothing could restrain, they hurried about in the destructive pursuit of prey, carrying a terrible vengeance in all directions.

And thus passed on the hours of the second day, and before night a sort of grim and savage silence was agreed upon among them, and they ceased to bewail either the loss of him they had loved, or their own uncertain destiny.

But on the morning of the third day, one of the Grub's favourite brothers came sailing into the midst of a group

who were just rousing up from rest, ready to commence the daily business of their life.

There was an unnatural brilliancy about his eyes, which shone as they had never done before, and startled all who looked at them, so that even the least observant had their attention arrested as he spoke.

" My friends," said he, " I was, as you know, one of our lost relative's favourite brothers. I trusted him, as if he had been a second self, and would have pledged myself a thousand times for his word. Judge, then, what I have suffered from his promise remaining still unfulfilled. Alas! that he has not yet returned to us! "

The favourite brother paused, and a little set in a corner by themselves murmured out, " How could he? The story about that other world is false."

" He has not returned to us," recommenced the favourite brother. " But, my friends, I feel that I am going to him, wherever that may be, either to that new life he spoke about, or to that death from which there is no return. Dear ones! I go, as he did, upwards, upwards, upwards! An irresistible desire compels me to it; but before I go, I renew to you—for myself and him—the solemn promise he once made to you. Should the great hopes be true, we will come back and tell you so. If I return not—but rely on me; my word is more to me than life. Adieu! "

The Grub rose upwards through the water followed by the last of the three brothers, and one or two of the younger ones; but on reaching the brink of the pond, he seized on a plant of the Forget-me-not, and clinging to its firm flower-stalk, clambered out of the water into the open air.

Those who accompanied him watched him as he left the water; but, after that, they saw no more. The blank of

his departure alone remained to them, and they sank down, sad and uneasy, to their home below.

As before, the hours of the day passed on, and not a trace of the departed one was seen. In vain they dwelt upon the consoling words he had spoken. The hope he had for a time re-awakened died out with the declining sun, and many a voice was raised against his treachery and want of love. "He is faithless," said some. "He forgets us, like his brother, in his new fortune," cried others. "The story of that other world is false," muttered the little set in the corner by themselves. Only a very few murmured to each other, "We will not despair."

. . . . . .

One thing alone was certain, he did not return; and the disappointed crowds took refuge from thought as before, in the fiercest rapine and excitement, scattering destruction around them wherever they moved.

Another day now elapsed, and then, in the early dawn following, the third and last brother crept slowly to a half-sleepy knot of his more particular friends, and roused them up.

"Look at my eyes," said he; "has not a sudden change come over them? They feel to me swelled and bursting, and yet I see with a clouded and imperfect vision. Doubtless it is with me now as it was with our dear ones before they left us. I am oppressed, like them. Like them, an invisible power is driving me upwards, as they were driven. Listen, then; for on my parting words you may depend. Let the other world be what it will, gorgeous beyond all we can fancy of it, blissful beyond all we can hope of it, do not fear in me an altered or forgetful heart. I dare not promise more. Yet if it be possible, I will return. But, remember, there may well be that other world, and yet we, in ours,

may misjudge its nature. Farewell, never part with hope. With your fears I know you never can part now. Farewell!"

And he too went upwards, through the cool water to the plants that bordered its side; and from the leaf of a golden King-cup he rose out of his native element into that aerial world, into which Water Grub's eye never yet could pierce.

His companions lingered awhile near the spot where he had disappeared, but neither sign nor sound came to them. Only the dreary sense of bereavement reminded them that he once had been.

Then followed the hours of vain expectation, the renewed disappointment, the cruel doubts, the hope that struggled with despair.

And after this, others went upwards in succession; for the time came to all when the lustrous eyes of the perfect creature shone through the masked face of the Grub, and he must needs pass forward to the fulfilment of his destiny.

But the result among those who were left was always the same. There were ever some that doubted and feared, ever some that disbelieved and ridiculed, ever some that hoped and looked forward.

Ah! if they could but have known, poor things! If those eyes, fitted for the narrow bounds of their water world, could have been endued with a power of vision into the purer element beyond, what a life-time of anxiety would they not have been spared! What ease, what rest would have been theirs!

But belief would, in that case, have been an irresistible necessity, and hope must have changed her name.

And the Dragon Fly, meanwhile, was he really faithless as they thought? When he burst his prison-house by the

water side, and rose on glittering wings into the Summer air, had he indeed no memory for the dear ones he had so lately left? No tender concern for their griefs and fears? No recollection of the promise he had made?

Ah! so far from it, he thought of them amidst the transports of his wildest flights, and returned ever and ever to the precincts of that world which had once been the only world to him. But in that region also, a power was over him superior to his own, and to it his will must submit. To the world of waters he could never more return.

The least touch upon its surface, as he skimmed over it with the purpose of descent, brought on a deadly shock, like that which, as a Water Grub, he had experienced from emerging into air, and his wings involuntarily bore him instantly back from the unnatural contact.

"Alas! for the promise made in ignorance and presumption, miserable Grub that I was," was his bitter, constantly-repeated cry.

And thus, divided and yet near, parted yet united by love, he hovered about the barrier that lay between them, never quite, perhaps, without a hope that some accident might bring his dear ones into sight.

Nor was his constancy unrewarded, for as, after even his longest roamings, he never failed to return to the old spot, he was there to welcome the emancipated brother, who so soon followed him.

And often, after that, the breezy air by the forest pond would resound in the bright Summer afternoons, with the clashing of Dragon Flies' wings, as, now backwards, now forwards, now to one side, now to another, without turn or intermission, they darted over the crystal water in the rapture of the new life.

It might be, on those occasions, that some fresh arrival

River Crayfish.

Caddis Fly and Larvæ in Cases.

SMOOTH TAILED STICKLEBACKS.

TEN SPINED STICKLEBACKS.

of kindred from below added a keener joy to their already joyous existence. Sweet assuredly it was to each newcomer, when the riddle of his fate was solved, to find in the new region, not a strange and friendless abode, but a home rich with the welcomes of those who had gone before.

Sweet also it was, and strange as sweet, to know that, even while they had been trembling and fearing in their ignorant life below, gleams from the wings of those they lamented were dropping like star-rays on their home, reflected hither and thither from the sun that shone above. Oh! if they could but have known!

Beautiful forest pond, crowded with mysterious life, of whose secrets we know so little, who would not willingly linger by your banks for study and for thought? There, where the Beech-tree throws out her graceful arms, glorying in the loveliness that is reflected beneath. There, where in the nominal silence the innocent birds pour out their music of joy. There, where the blue Forget-me-not tells its tale of old romance, and the long Grasses bend over their pictured shadows. There, where the Dragon Flies still hover on the surface of the water, longing to reassure the hearts of the trembling race, who are still hoping and fearing below.

THE TEMPLE PRESS, PRINTERS, LETCHWORTH

CALENDAR AND NOTES

OF

ANIMALS AND PLANTS

COMPILED BY C. S. COOPER, F.R.H.S.

I. BIRDS

GREENFINCH.—A resident in Britain; many migrate to the east coast in Autumn; also a regular migration on south coast in Spring and Autumn. *Male bird:* general colour above olive-yellow, shaded with ashy-grey, especially on the head; cheeks and under-surface of body bright yellow, with ashy tinge; lower abdomen white; tail-feathers yellow at base; bill fleshy pink; feet brown; length 6 inches. *Female:* duller in colour; tail-feathers not yellow at base. *Nest:* April onwards; in shrubberies, hedgerows, and evergreen trees; twigs and rootlets, with lining of horse-hair and a few feathers; *eggs*, 4–6; variable; white, suffused with bluish tinge, spotted and streaked with pinkish or purple. *Food:* seeds, grain, and insects; young largely fed upon caterpillars. *Song:* chiefly a long, plaintive note while on the wing; often improves considerably in captivity.

GREY WAGTAIL.—A somewhat local species; a partial migrant, many going northward in the Summer, and southward in the Winter. *Male bird:* back and head bluish-grey; throat black, with a white streak on each side; breast yellow; bill black; in Winter the throat is white; length 6¾ inches. *Female:* similar, but less black on throat;

length 7 inches. *Nest:* April–June; usually near a stream, on banks or shelves of rock, in quarries, etc.; roots and moss, lined with hair; *eggs:* 5 or 6, pale French-grey, mottled with creamy-brown. *Food:* insects. *Call-note:* "chita-chita."

HERON.—A resident. *Male bird:* general colour above light ashy-grey; bluish-black crest, with two long drooping black plumes; face, neck, and under-surface of body white; fore-neck and chest with long white feathers; bill yellow; feet dull green; length 30 inches. *Female:* similar to male. *Nest:* March and onwards; usually on the topmost branches of high trees; sticks, with a lining of finer twigs; *eggs:* 3 or 4, greenish-blue. *Food:* fish, insects, snails, reptiles, Rats. *Call:* a harsh cry, something like that of Peacock.

KINGFISHER.—A resident. *Male bird:* general colour greenish-blue; back cobalt-blue; crown greenish-blue; sides of face orange-red; cheeks with stripe of bright blue; under-surface orange-red; bill black; feet coral-red; length 7½ inches. *Female:* similar, but less bright in colour; basal half of the under mandible red; length 7 inches. *Nest:* March–July; usually a hole in a river-bank; *eggs:* 6 or 7, pure glossy white, nearly spherical; laid on a heap of fish-bones. *Food:* fish and insects. *Call:* a kind of shrill "h'wee-h'wee," uttered very quickly when on the wing.

MUTE SWAN.—A resident, said to have been first brought to England by Richard I. from Cyprus. *Male bird:* body white all over; nostrils and lores black; bill reddish-orange; legs and feet dull black; length 5 feet; weight about 30 lbs. *Female:* similar, but a little smaller. *Nest:* April and May; generally near the edge of water; dead reeds and grass; *eggs:* 6 or 7, dull greenish-white. *Food:* aquatic plants, snails and insects. *Call:* a loud, trumpet-like note.

REED BUNTING.—A resident. *Male bird:* reddish above, streaked with black, with pale edgings to feathers; lower back ashy-grey; head and throat black; under-surface white, streaked with black on sides and flank; length 6 inches. *Female:* throat ashy fulvous, with a black streak on the sides; crown brown, streaked with black; under-surface white, streaked with dusky brown; length about 5 inches. *Nest:* March–July; generally low down in a marshy bank; dried grass, moss, reeds, with lining of fine grass and hair; *eggs:* 4-6, greenish or brownish-grey, scribbled and blotched with black. *Food:* insects, seeds, and grain. *Song:* a few short, shrill notes, succeeded by a long one; sounding like "sherrip" pronounced quickly.

SEDGE WARBLER.—A Summer visitor, arriving at end of April, leaving at beginning of October for South Africa. *Male bird:* russet-brown above, with dusky brown centres to feathers; yellowish-white streak over eye; throat and centre of breast and abdomen white; fore-neck, chest, and sides tawny-buff; bill brown; feet pale-brown; length 5 inches. *Female:* somewhat duller in colour; length 5 inches. *Nest:* May and June; among rushes, or in a bush beside a stream or ditch, or occasionally on the ground; stems of plants, coarse grass, and moss, with a lining of hair; *eggs:* 4-6, olive to brown or stone-grey, mottled with darker brown, often with a hair-like line of black. *Food:* insects, Earthworms, slugs and small caterpillars. *Song:* lively and modulated, very varied, uttered in a hurried manner; introduces the notes of other birds.

II. FISH

DACE.—*Body:* resembling Roach, but narrower and more tapering, silvery-blue, anal fin concave. *Weight:* rarely exceeding 1 lb. *Eggs:*

laid in May and June. *Food:* insects and vegetable matter. *Habits:* they prefer running water, and travel about in shoals.

GUDGEON.—*Body:* long and tapering; one barbel on each side of jaw; length rarely exceeding 7 inches. *Colour:* greyish, with dark blotches above, greatly resembling the surroundings. *Weight:* average 1–2 ozs. *Food:* water insects and worms. *Habits:* they prefer clear streams with gravelly bottoms, where they lie in shoals.

MINNOW.—*Body:* long and tapering. *Colour:* dark green, with patches of black along the back; silvery below; breast fins with tinge of red; in breeding season the males are bright with crimson and green; length about 3 inches. *Weight:* average ¼ oz. *Food:* water insects, flies, and midges. *Habits:* they live in shoals in the shallower parts of the river.

RIVER EEL.—*Body:* long and round, green above, white or yellowish below; head long and pointed or bloated. *Male:* greatest length about 1 foot 7 inches. *Female:* length nearly 4 feet. *Weight:* 3–6 lbs. *Eggs:* laid in the deep sea in Autumn. *Fry:* transparent, compressed from side to side, little thicker than a sheet of stout paper; head very small. *Young eels or "elvers":* quite transparent; 2–5 inches long; enter the rivers February–May. *Food:* young fish. *Habits:* they hide in mud during day, and come out in search of food at night; will travel over land if the ground be wet.

THREE-SPINED STICKLEBACK.—*Body:* long and thin; three spines on the back, two at the sides. *Colour:* grey and golden; males in the breeding season very brilliant, upper parts bright blue, lower parts crimson, eye green. *Weight:* average ¼ oz. *Eggs:* laid during April in a barrel-shaped nest made of weeds by the male. *Food:* water insects, Fresh-water Shrimps, etc. *Habits:* the male guards the nest and will attack all comers; he is a bold fighter.

TROUT.—*Body:* thick. *Colour:* very variable; general colour yellowish; upper parts spotted with black and red, under surface silvery-white or yellow; fins light brown. *Weight:* up to 14 or 15 lbs.; average 2–5 lbs. *Eggs:* yellowish, with red yolk; laid in Autumn in a depression of the river bottom, and covered with gravel; hatch in following Spring. *Alevin:* eyes very prominent; yolk-bag beneath body; mouth not developed. *Yearling:* about 3 inches in length; sides of back spotted. *Food:* worms, snails, Fresh-water Shrimps, flies. *Habits:* very voracious; said to live over thirty years.

III. INSECTS

COMMON GNAT.—*Male:* antennæ very feathery. *Female:* antennæ plumed, but not so feathery; mouth provided with sharp lancets. *Eggs:* 200–300, laid in form of a raft in still water, plentiful in Summer. *Larva:* body slender and flexible; head and thorax large; breathes through special tube at hinder end of body. *Pupa:* "head" very large—consists of head, thorax, wings, and legs of future Gnat; breathes through a pair of stout tubes (respiratory trumpets) attached to the first thoracic segment; swims about, but takes no nourishment.

COMMON MAYFLY.—May and June. *Body:* long and slender; mouth rudimentary, not able to absorb food; wings gauzy, hind pair very small; three slender filaments at end of body. *Eggs:* laid in packets on the water; *Larva:* body ½ inch long; jaws strong; a row of thin, plate-like gills on each side of body; three feathery filaments at end; lives for about three years; burrows ⊂-shaped; feeds on vegetable matter. *Nymph:* resembles larva, but has rudimentary wings. *Pseud-imago or "Green Drake":* apparently a perfect insect, but covered with a skin. *Imago or "Grey Drake":* emerges from skin, and flies away; seldom lives for more than a few hours.

GREAT CADDIS FLY.—*Body:* $\frac{7}{8}$ inch long, stout, hairy; wings brown, very heavy, thickly covered with hair, expanding $1\frac{3}{4}$–$2\frac{1}{4}$ inches. *Eggs:* green; in a double cluster, held together by a gelatinous secretion; carried by female at extremity of body; mass affixed to stem of an aquatic plant, often a foot below surface of water. *Larva:* lives in a tube made of pieces of leaves and other vegetable matters arranged in a spiral manner; tube of large diameter, enabling larva to turn round inside, and appear at either end; head and thorax protected by horny covering. *Pupa:* passes stage in tube.

LESSER CADDIS FLY.—*Body:* yellowish-brown; head and thorax with yellowish down; upper wings pale brown, variegated with dark brown; expanding $\frac{7}{8}$ inch; lower wings shining and iridescent. *Eggs:* held together in a mass by a gelatinous secretion, and affixed to the stem of a water plant. *Larva:* head and thorax horny; rest of body soft; tail-segment with a pair of hooks; lives in a tube made of vegetable matter; feeds on water-plants and insects. *Pupa:* passes stage inside tube, with ends closed up. *Imago or Fly:* takes no food; dies in a few days.

WATER MEASURER.—*Body:* $\frac{1}{2}$ inch long; blackish-brown above, black beneath; covered with velvet-like pile; elytra blackish-brown; front pair of legs short, used for seizing prey; middle pair the longest. *Food:* aquatic insects, Water-fleas, etc.

IV. MAMMALS

WATER SHREW.—A native of Britain. *Body:* generally black above and white beneath; ears small; teeth 30, tips stained brownish-red; feet fringed with stiff white hairs; tail with similar hairs on lower surface. *Length* of head and body about $3\frac{1}{4}$ inches; tail about 2 inches. *Inhabits* winding burrows excavated in banks of rivulets,

brooks, ditches, and ponds; swims well, and dives with ease to the bottom. *Food:* aquatic insects and larvæ, crustaceans and snails.

WATER VOLE.—A native of Britain. *Body:* covered with long and thick fur, usually greyish-brown with reddish tinge, but sometimes wholly black; head with a blunt, rounded muzzle; ears short, buried in fur; hind-feet long. *Length* of head and body 8½ inches; tail 4½ inches. *Inhabits* banks of rivers, canals, brooks, and ponds, forming long burrows; swims and dives with ease. *Food:* vegetable substances, chiefly roots and grass.

V. MISCELLANEOUS

CRAYFISH.—*Body:* consists of twenty rings, forming the so-called "head" and "tail"; former, true head and thorax; latter, abdomen; hind pair of antennæ very long; five pairs of walking-legs, first pair bearing large "pincers." *Colour:* green. *Eggs:* laid in November and December; carried in masses called "berries," attached to female's legs; hatched in following May or June. *Food:* worms, insects, snails, and other animal matter. *Habits:* hides in a hole or burrow, catches prey chiefly at night.

VI. TREES AND FLOWERING PLANTS

Name.	Time of Flowering.	Colour.	Height.
Aspen . . .	Mar. April	Reddish	Tree
Comfrey . . .	May June	Purple or Yellowish-White	1–3 ft.
Brooklime . . .	May—Sept.	Bright blue	1–2 ft.
Water-cress . .	May—Oct.	White	2–3 ft.
Greater Willow Herb .	July Sept.	Lilac-pink	4–5 ft.
Great Yellow Loose-strife	„ „	Yellow	2–3 ft.
Purple Loosestrife .	„ —Sept.	Purple, inclining	2–4 ft.
Hemp Agrimony .	„ —Oct.	Dull Pink	3–6 ft.

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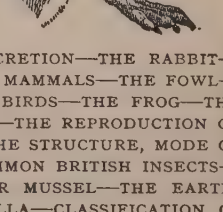

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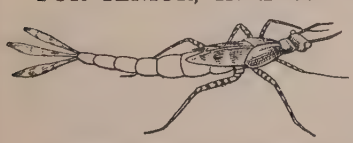

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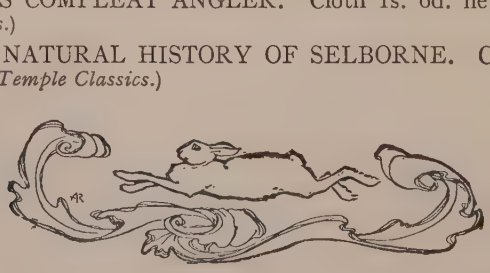
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